UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/814,302	04/01/2004	D. Amnon Silverstein	200309882-1	6116

22879 7590 08/21/2008
HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER	
THOMAS, MIA M	

ART UNIT	PAPER NUMBER
2624	

NOTIFICATION DATE	DELIVERY MODE
08/21/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

JERRY.SHORMA@HP.COM
mkraft@hp.com
ipa.mail@hp.com

Office Action Summary	Application No.	Applicant(s)	
	10/814,302	SILVERSTEIN ET AL.	
	Examiner	Art Unit	
	Mia M. Thomas	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 May 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 5-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 5-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 May 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to applicant's remarks. Applicant hereby adds new claims 37-41 and cancel claim 4. The new claims and amendments are supported at least by the teachings of Fig 2, 3 and paragraphs [0031-0037].

Continued Examination Under 37 CFR 1.114

2. The request for a continued prosecution application (CPA) under 37 CFR 1.53(d) filed on [1] is acknowledged. 37 CFR 1.53(d)(1) was amended to provide that the CPA must be for a design patent and the prior application of the CPA must be a design application that is complete as defined by 37 CFR 1.51(b). See *Elimination of Continued Prosecution Application Practice as to Utility and Plant Patent* Applications, final rule, 68 *Fed. Reg.* 32376 (May 30, 2003), 1271 *Off. Gaz. Pat. Office* 143 (June 24, 2003). Since a CPA of this application is not permitted under 37 CFR 1.53(d)(1), the improper request for a CPA is being treated as a request for continued examination of this application under 37 CFR 1.114.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 33, 35 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herman (US 6,075,905) in combination with Peterson US (6,411,742 B1).

Regarding Claim 1: (Currently Amended) Herman teaches a method for blending images into a single image (Refer to abstract) comprising:

selecting two images having overlapping content (Refer to Figure 9, numeral 718);

dividing the two images into strips ~~along a common plane wherein each strip is a long and narrow piece of the image~~ (Refer to column 11,line 12+);

selecting a strip ~~of uniform width~~ in each of the two images where the two images overlap each other ("An effective image processing means for automatically selecting region of each source image to be included in the mosaic from the overlapped regions" at column 2,line 58);
determining differences between the overlapping two strips (Refer to column 9, line 43);

Herman does not expressly teach determining a line through the overlapping strips where the differences between the overlapping strips are minimized.

Peterson teaches determining a line through the overlapping strips where the differences between the overlapping strips are minimized (Refer to column 5,line 17+; also refer to Figure 3c, 3c-1 by way of numeral 54);

and blending the two images together along the minimized line to create a single image (Refer to column 1, line 51).

Herman and Peterson are combinable because they are in the same field of merging images into panoramic images (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to determine a line through overlapping strips where the differences between the overlapping strips are minimized and blending the two images together along the minimized line to create a single image.

The suggestion/motivation for doing so would be to "determine the position of one image to another image that is arbitrarily positioned relative to that said other image. It also allow the operand to blend image that may have arbitrary shapes and sizes." at column 1, line 50+, Peterson.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman in combination with Peterson to obtain the specified claimed elements of Claim 1.

Regarding Claim 33: Claim 33 equally discloses the claimed invention of Claim 1. Claim 33 is rejected for the same reasons as listed above at Claim 1. Claim 33 is the computer readable medium encoded with software that resembles the claimed method of Claim 1. Peterson discloses ("In general, another aspect of the invention relates to an article that includes a

computer readable medium, which stores computer-executable instructions for blending images of segments of a view according to the method described above." at column 1, line 46).

Regarding Claim 2: (Original) Peterson teaches the selected images belong to a set of two or more images comprising a scene ("Referring again to FIG. 1, the positioning module 50 of the image stitching software 14 determines the relative positions of the segments depicted in two of the images 18a-18d so that an image of an object depicted in one of the images can be aligned with another image of the same object." at column 3, line 59).

Regarding Claim 35: (Original) Peterson teaches the two overlapping strips are selected according to a mean squared difference algorithm such that the sum of the mean squared difference values between the two selected strips is minimized ("For example, the top left corner of the doorway is horizontally displaced from the bottom left corner of the image by a distance x0 in the first images 18a, while it is displaced by a distance x1 in the second image 18a. Consequently the second image is displaced to the left of the first image by a distance (d-left) given by the mathematical equation: d-left = x0-x1." at column 4, line 12).

Regarding Claim 40: (New) Herman teaches the determining differences comprises determining differences between the image data content comprising color space content of the overlapping two strips ("The physics of image creation provides strong motivation for affine color correction. Under fairly general and natural circumstances, an affine transformation in color space compensates for (a) color-space differences between the two images due to different acquisition systems;…" at column 15,line 23).

5. Claims 3, 34, 37-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herman (US 6,075,905) in combination with Peterson US (6,411,742 B1) and further in view of Kang et al (US 20030235344 A1).

Regarding Claim 3: (Original)

Herman and Peterson in combination teaches all the claimed elements as listed above. Herman and Peterson in combination does not specifically teach the selected images differ from each other based on at least recording time, camera location, camera setting, lighting, shadows, and/or background.

However, Kang teaches the selected images differ from each other based on at least recording time, camera location, camera setting, lighting, shadows, and/or background (Refer to paragraph [0015]).

Herman, Peterson and Kang are combinable because they are in the same field of image transformations specifically combining image portions. (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to select images differing in one of recording time, camera location, camera settings, lighting shadows, and/or background.

The suggestion/motivation for doing so would have been to "have known parameters at a known point in space had been used to acquire the image…" at paragraph [0014], Kang.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teaching of Herman and Peterson with Kang to obtain all the specified claimed elements of Claim 3.

Regarding Claim 4: (Canceled)

Regarding Claim 34: (Original) Kang teaches the software wherein the selected images differ from each other based on at least recording time, camera location, camera setting, lighting, shadows, and/or background (Refer to paragraph [0015]).

Regarding Claim 37: (New) Kang teaches wherein the selecting comprises selecting the strips of the two images which provide reduced error between the selected overlapping two strips compared with non-selected strips of the two images (Refer to paragraph [0007]).

Regarding Claim 38: (New) Kang teaches the determining differences comprises determining differences between image data content of the overlapping two strips (Refer to paragraph [0057]).

Regarding Claim 39: (New) Kang teaches the determining differences between image data content comprises determining differences between the image data content of one pixel of one of the overlapping two strips and one pixel of another of the overlapping two strips and wherein the one pixels of the one and the another of the overlapping two strips both correspond to the same subject present in the two images (Refer to paragraph [0050]).

6. Claims 5, 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herman (US 6,075,905) in combination with Peterson US (6,411,742 B1) and further in view of Peleg (US 2003-0076406 A1).

Regarding Claim 5 (Original)**:** Herman and Peterson in combination teaches all the claimed elements as listed above. Herman and Peterson in combination does not specifically teach the selected images are divided along a common plane.

However, Peleg teaches the selected images are divided along a common plane (Refer to Figure 6, numeral 604; for an additional example, see Figure 7, numeral 704, paragraph [0114]).

Herman, Peterson and Peleg are combinable because they are in the same field of image transformations specifically combining image portions. (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to teach/disclose the selected images are divided along a common plane.

The suggestion/motivation for doing so would have been “to address three major issues in traditional image mosaicing, image alignment, image cut and paste and image blending." (Refer to paragraphs [0031-0035], Peleg).

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman and Peterson with Peleg to obtain all the specified claimed elements of Claim 5.

Regarding Claim 8: (Original) Peleg teaches cutting the selected images along the minimized line (Refer to Figure 4, numeral 405 or refer to Figure 6, numeral 601, item S2 ("dotted dashed lines") and numeral 603, item S2 ("dotted dashed lines") and joining the cut images together to create the single image of the scene (Refer to paragraph [0053-0055]).

7. Claims 6, 7, 14, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herman (US 6,075,905) in combination with Peterson US (6,411,742 B1) and further in view of Xiong (US 6,549,651 B2).

Regarding Claim 6: (Original) Herman and Peterson in combination teaches all the claimed elements as rejected above. Herman and Peterson in combination does not specifically teach the selected images are divided into strips along one of a vertical plane or a horizontal plane.

However, Xiong teaches the selected images are divided into strips along one of a vertical plane or a horizontal plane ("Further, the present invention, unlike some of the prior art, allows for multiple views, from multiple planes and rows of images, and allows for the arbitrary orientation of photographic images to be constructed into a panorama, without specialized hardware such as a tripod or fisheye lens. In addition, the present system and method can be several orders of magnitude faster than the prior art." at column 2, line 27).

Herman, Peterson and Xiong are combinable because they are in the same field of image transformations specifically combining image portions. (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to teach/disclose the selected images are divided into strips along one of a vertical plane or a horizontal plane.

The suggestion/motivation for doing so would have been “to provide a registration, calibration and global optimization for each of the images being processed." (see column 2, line 2, Xiong)

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman and Peterson with Xiong to obtain all the specified claimed elements of Claim 5.

Regarding Claim 7: (Original) Peterson teaches the two overlapping strips are selected according to a mean squared difference algorithm such that the sum of the mean squared difference values between the two selected strips is minimized (“For example, the top left corner of the doorway is horizontally displaced from the bottom left corner of the image by a distance x0 in the first images 18a, while it is displaced by a distance x1 in the second image 18a. Consequently the second image is displaced to the left of the first image by a distance (d-left) given by the mathematical equation: d-left = x0-x1.” at column 4, line 12).

Regarding Claim 14 (Original)**:** Peterson teaches the blending of images is performed iteratively (“Referring to Figure 2B, image stitching software 14, blends the images 18a-18d so to generate a single panoramic image 26…” at column 3, line 52), with the blended single image being utilized as one of the selected two images to be blended (“If there are more images, the

stitching software 14 sets (224) the reference image to be the next image after the current image and repeats the process…" at column 5, line 48).

Regarding Claim 15: Peterson teaches the method of blending is performed iteratively (Figure 2B describes the method of blending images iteratively by blending any of images 18a-18d; "…image stitching software 14, blends the images 18a-18d so to generate a single panoramic image 26…" at column 3, line 52) until all images comprising the scene have been blended into a final single image of the scene ("Consequently, additional processing is required to blend the images into each other and create the near seamless panoramic image 26 (Figure 2B)." at column 4, line 45).

8. Claims 9-11, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herman (US 6,075,905) in combination with Peterson US (6,411,742 B1) and further in view of Pham et al. "Color Correction for an Image Sequence", 1995, IEEE, pages 38-42 and Kang et al (US 20030235344 A1).

Regarding Claim 9: (Original) Herman and Peterson in combination teaches all the claimed elements as rejected above. Herman and Peterson in combination does not specifically teach calculating a squared color difference value for each pixel pair between the overlapping strips; converting the squared color difference values into a gray scale image of the overlapping strips, wherein the brightest pixels in the gray scale image correspond to the pixels of greatest difference between the two overlapping strips sorting the gray scale pixels from largest to smallest difference value; for each sorted gray scale pixel, mapping the gray scale pixel to one of two regions within the overlapping strip according to the adjacency of the gray scale pixel to

the one of the two regions; determining a cut line between the two regions; cutting each selected image along the cut line within the overlapping strip of each selected image; and combining the two cut selected images along the cut line to form the single image.

However, Pham teaches calculating a squared color difference value for each pixel pair between the overlapping strips (Refer to page 38; "This color correction technique constructs a mapping from the registered overlapping regions of two adjacent images in an image sequence. It uses multiple regression to minimize color differences. Also see right column, "Mapping Construction", paragraph 2);

Kang teaches converting the squared color difference values into a gray scale image of the overlapping strips, wherein the brightest pixels in the gray scale image correspond to the pixels of greatest difference between the two overlapping strips (Refer to paragraph [0012],[0051]); sorting the gray scale pixels from largest to smallest difference value; for each sorted gray scale pixel, mapping the gray scale pixel to one of two regions within the overlapping strip according to the adjacency of the gray scale pixel to the one of the two regions; determining a cut line between the two regions (Refer to paragraph [0051]); cutting each selected image along the cut line within the overlapping strip of each selected image (Refer to Figure 2, numeral 250); and combining the two cut selected images along the cut line to form the single image (Refer to Figure 6, numeral 660, paragraph [0098]).

Herman, Peterson Pham and Kang are combinable because they are in the same field of image transformations specifically combining image portions. (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman, Peterson, Pham and Kang. All of the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination of Herman, Peterson, Pham and Kang would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

The suggestion/motivation for doing so would have been "…because the multiperspective plane sweep approach described herein is both computationally efficient, and applicable to both the case of limited overlap between the images used for creating the image mosaics, and to the case of extensive or increased image overlap." at paragraph [0051], Kang.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman and Peterson with Pham and Kang to obtain all the specified claimed elements of Claim 9.

Regarding Claim 36: (Original) Pham teaches calculating a difference value for each pixel pair between the two overlapping strips (Refer to page 38; "This color correction technique constructs a mapping from the registered overlapping regions of two adjacent images in an image sequence. It uses multiple regression to minimize color differences. Also see right column, "Mapping Construction", paragraph 2);

Kang teaches converting the calculated difference values into a gray scale image of the overlapping strips, wherein the brightest pixels in the gray scale image correspond to the pixels of greatest difference between the two overlapping strips (Refer to paragraph [0012],[0051]); sorting the gray scale pixels from largest to smallest difference value; for each sorted gray scale pixel, mapping the gray scale pixel to a first region or a second region within the overlapping strip according to the adjacency of the gray scale pixel to the first region or the second region (Refer to paragraph [0051]); determining a cut line within the overlapping strips between the first mapped region and the second mapped region(Refer to Figure 2, numeral 250); cutting each selected image along the cut line of the overlapping strip of each selected image (Refer to Figure 2, numeral 250); and combining the two cut selected images along the cut line to form the single image (Refer to Figure 6, numeral 660, paragraph [0098]).

Herman, Peterson Pham and Kang are combinable because they are in the same field of image transformations specifically combining image portions. (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman, Peterson, Pham and Kang. All of the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination of Herman, Peterson, Pham and Kang would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

The suggestion/motivation for doing so would have been "…because the multiperspective plane sweep approach described herein is both computationally efficient, and applicable to both the case of limited overlap between the images used for creating the image mosaics, and to the case of extensive or increased image overlap." at paragraph [0051], Kang.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herman and Peterson with Pham and Kang to obtain all the specified claimed elements of Claim 36.

Regarding Claim 10: (Original) Peterson teaches the cut line is determined between a first region and a second region to which the pixels have been mapped ("The second image is divided into the first and second section by a dividing line that is determined based on an outline of the first image…" at column 2, line 22).

Regarding Claim 11: (Original) Peterson teaches the cut line corresponds to the line of best match between the overlapping strips ("For example, a seam 62 is created…where the two images 18c and 18d join each other…and create a near seamless panoramic image 26 (Figure 2b) ", at column 4, line 42).

9. Claims 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herman (US 6,075,905) in combination with Peterson US (6,411,742 B1) and Pham et al. "Color Correction for an Image Sequence", 1995, IEEE, pages 38-42 further in view of Kang et al (US 20030235344 A1) and further in view of Xiong (US 5,549,651 B2).

Regarding Claim 12: (Original) Herman, Peterson, Pham and Kang in combination disclose/teach all the claimed elements as rejected above. Herman, Peterson, Pham and Kang in combination does not expressly teach at least one of the cut images is warped along the cut line to improve the fit between the two cut images along the cut line.

Xiong teaches at least one of the cut images is warped along the cut line to improve the fit between the two cut images along the cut line ("The present invention is designed to calibrate and align all such 2D rectilinear images with respect to one another and globally, blend the images where they overlap, and construct a reconstructed and relatively error free 3D panorama image, shown conceptually in 2D form as FIG. 1(b), for any arbitrary geometry." at column 3, line 47).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to calculate at least one of the cut images as to warp along the cut line to improve the fit between the two cut images along the cut line.

Herman, Peterson, Pham, Kang and Xiong are combinable because they are in the same field of creating high quality virtual panoramas. (See abstract Xiong).

The suggestion/motivation for doing so would have been to "yield dramatic improvements during the mathematical, authorization processes and projection cycles with speeds up to several order of magnitude faster than any prior system." (Abstract, Xiong).

Therefore, it would have been obvious to one of ordinary skill in the art to combine the claimed elements of Herman, Peterson, Pham, Kang and Xiong to obtain the specified claimed elements of Claim 12.

Regarding Claim 13: (Original) Xiong teaches a Gaussian function is used to warp the at least one cut image ("The third step re-projects all images…by employing Laplacian pyramid based blending using a Gaussian blend mask…" at column 2, line 18).

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson US (6,411,742 B1) and Kang et al (US20030235344 A1).

Regarding Claim 16: (Currently Amended) Peterson teaches a method for blending images into a single image (Refer to column 1, line 6)

determining a line through the selected overlapping strips where differences between the selected overlapping strips are minimized (Figure 3c; "The dividing line determiner 54 determines an outline 74 (Fig. 3c)…formed by aligning the current image 18b' and the reference image 18a…" at column 5, line 25 (e.g. Figure 3a, numeral 214 and 216)); blending the two images along the determined minimized line to create a single image (Refer to column 1, line 51);

Peterson does not expressly teach dividing two images into strips along a common plane and wherein the selecting comprises selecting the overlapping strips which have reduced error between the selected overlapping strips compared with non-selected overlapping strips of the two images and warping the single image to minimize blurring along the blending line.

Kang teaches dividing two images into strips along a common plane ~~wherein each strips are long and narrow piece of the image;~~ (Refer to paragraph [0011]; further at Figures 3a and 3b) selecting a strip ~~of uniform width~~ in each image where the two images overlap (Refer to Figure 6, numeral 600), <u>wherein the selecting comprises selecting the overlapping strips which have reduced error between the selected overlapping strips compared with non-selected overlapping strips of the two images</u> (Refer to Figure 6);

and warping the single image to minimize blurring along the blending line. ("Even if the camera motion is not horizontal, the images are warped or "rectified" to produce an effective horizontal camera motion." at paragraph [0011]).

Peterson and Kang are combinable because they are in the same field of merging images into panoramic images (see title of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to divide two images into strips along a common plane and select the overlapping strips which have reduced error between the selected overlapping strips compared with non-selected overlapping strips of the two images and warping the single image to minimize blurring along the blending line.

The suggestion/motivation for doing so would be that "better mosaicing will result if the boundaries of the strip are taken to be approximately perpendicular to the "optical flow" (local image displacement) generated by the camera motion. Examples are camera translations: sideways motion, forward motion, and a general translation; as well as camera zoom." @

paragraph [0111]. Warping also allows the user of this method to form, shape, bend and stretch the images to obtain a best match for providing a seamless match of a blended single image.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Peterson with Kang to obtain the specified claimed elements of Claim 16.

11. Claims 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson US (6,411,742 B1) and Kang et al (US20030235344 A1) and further in view of Xiong (US 5,549,651 B2).

Regarding Claim 17 (Currently Amended): Peterson and Kang in combination disclose/teach all the claimed elements as rejected above. Peterson and Kang in combination does not expressly teach at least one of the cut images is warped along the cut line to improve the fit between the two cut images along the cut line.

Xiong teaches the minimized line is determined by calculating mean squared difference values for pairs of pixels between the two <u>selected</u> overlapping image strips. ("Different combinations of overlapping areas are tried to achieve the optimal overlap between images (or, equivalently, the smallest error in the error function or pair wise objective function described herein) using the steps described herein, which generally minimizes the average squared pixel intensity (e.g., brightness and contrast) difference with respect to certain transformation parameters." at column 4, line 65).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to calculate the minimized line is determined by calculating mean squared difference values for pairs of pixels between the two selected overlapping image strips.

Peterson, Kang and Xiong are combinable because they are in the same field of creating high quality virtual panoramas. (See abstract Xiong).

The suggestion/motivation for doing so would have been to "yield dramatic improvements during the mathematical, authorization processes and projection cycles with speeds up to several order of magnitude faster than any prior system." (Abstract, Xiong).

Therefore, it would have been obvious to one of ordinary skill in the art to combine the claimed elements of Peterson, Kang and Xiong to obtain the specified claimed elements of Claim 17.

Regarding Claim 18 (Currently Amended): Xiong teaches at least one of the images is warped where the differences between the selected overlapping strips along the blending line exceed a predetermined threshold (Where the images overlap there is potential for misalignment when constructing a 3D panorama, as indicated by blurry lines 112, for a variety of reasons, ... distortions that occur when warping a 2D image to construct a 3D image space. The present invention is designed to calibrate and align all such 2D rectilinear images with respect to one another and globally, blend the images where they overlap, and construct a reconstructed and relatively error free 3D panorama image, shown conceptually in 2D form as FIG. 1(b), for any arbitrary geometry." at column 3, line 41).

Regarding Claim 19 (Original): Xiong teaches wherein the single image is warped by application of a Gaussian function ("The Gaussian pyramid may be constructed by applying a low-pass filter to the blend mask, which dilutes the sharp edges, from linear interpolation between the black and white regions of the blend mask, or from other techniques." at column 15, line 48).

Regarding Claim 20 (Original): Xiong teaches where the Gaussian function is applied iteratively along a plurality of planes and with a plurality of magnitudes of warp to determine the best fit between the images. ("The local pair wise registration module 222 iterates until the entire Gaussian pyramid is traversed…and working out the finest level resolution, as indicated in decision box 324." at column 5, line 27).

12. Claims 21, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson US (6,411,742 B1) in combination with Peleg (US 2003-0076406 A1) and Pham et al. "Color Correction for an Image Sequence", pages 38-42.

Regarding Claim 21 (Currently Amended): Peterson teaches computer-based system for blending images into a single image (Refer to Figure 1, numeral 10), determine a line through the overlapping strips where the sum of the pixel difference values between the overlapping strips are minimized (Refer to column 5,line 17+; also refer to Figure 3c, 3c-1 by way of numeral 54); and blend the two images together along the minimized line to create a single image (Refer to column 1, line 51).

Peleg teaches: divide two images having overlapping content into strips along a common plane wherein each strip is a long and narrow piece of the image <u>having one dimension which is greater than another dimension of the respective strip</u> (Refer to Figure 6, numerals 601-604); select a strip of uniform width in each of the two images where the two images overlap each other (Refer to paragraph [0140]);

Peterson in combination with Peleg does not specifically teach/disclose determining pixel difference values between the overlapping two strips.

Pham teaches determine pixel difference values between the overlapping two strips (Refer to page 38, Section "Mapping Construction"; "We wish to find a mapping that will convert the color value of each of the pixels in A' to the corresponding pixel color value in B'.")

Peterson, Peleg and Pham are combinable because they are in the same field of merging images into panoramic images (see title of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to determine pixel difference values between the overlapping two strips.

The suggestion/motivation for doing so would be that to create an environment that eases "multiple regression steps to find the relationship between the registered overlapping regions of two adjacent images in a sequence." see page 38, right column, paragraph 2, Pham.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Peterson, Peleg and Pham to obtain the specified claimed elements of Claim 21.

Regarding Claim 22: (Original) Peterson teaches wherein the two overlapping strips are selected according to a mean squared difference algorithm such that the sum of the mean squared difference values between the two strips is minimized ("For example, the top left corner of the doorway is horizontally displaced from the bottom left corner of the image by a distance x0 in the first images 18a, while it is displaced by a distance x1 in the second image 18a. Consequently the second image is displaced to the left of the first image by a distance (d-left) given by the mathematical equation: d-left = x0-x1." at column 4, line 12).

13. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson US (6,411,742 B1) in combination with Peleg (US 2003-0076406 A1) and Pham et al. "Color Correction for an Image Sequence", 1995, IEEE, pages 38-42, and further in view of Kang et al (US 20030235344 A1).

Regarding Claim 23: (Original) Peterson in combination with Peleg and Pham teaches all the claimed elements as rejected above. Peterson in combination with Peleg and Pham does not specifically teach calculating a squared color difference value for each pixel pair between the overlapping strips; converting the squared color difference values into a gray scale image of the overlapping strips, wherein the brightest pixels in the gray scale image correspond to the pixels of greatest difference between the two overlapping strips sorting the gray scale pixels from largest to smallest difference value; for each sorted gray scale pixel, mapping the gray scale pixel to one of two regions within the overlapping strip according to the adjacency of the gray

scale pixel to the one of the two regions; determining a cut line between the two regions; cutting each selected image along the cut line within the overlapping strip of each selected image; and combining the two cut selected images along the cut line to form the single image.

However, Pham teaches calculating a squared color difference value for each pixel pair between the overlapping strips (Refer to page 38; "This color correction technique constructs a mapping from the registered overlapping regions of two adjacent images in an image sequence. It uses multiple regression to minimize color differences. Also see right column, "Mapping Construction", paragraph 2);

and

Kang teaches convert the squared color difference values into a gray scale image of the overlapping strips, wherein the brightest pixels in the gray scale image correspond to the pixels of greatest difference between the two overlapping strips (Refer to paragraph [0012],[0051], also refer to Figure 1); sort the gray scale pixels from largest to smallest difference value (Refer to Figure 1, numeral 145, 146); for each sorted gray scale pixel, map the gray scale pixel to one of two regions within the overlapping strip according to the adjacency of the sort gray scale pixel to the one of the two regions (Refer to paragraph [0051], also refer to Figure 1, numeral 15, 146, 135, 136); determine a cut line between the two regions (Refer to Figure 2, numeral 250, also refer to Figure 1, numeral 145, 146); cut each image along the cut line of the overlapping strip of each image (Refer to Figure 2, numeral 250, also refer to Figure 1, numeral 145, 146); and combine the two cut images along the cut line to form the single image (Refer to Figure 6, numeral 660, paragraph [0098]).

Peterson, Peleg, Pham and Kang are combinable because they are in the same field of image transformations specifically combining image portions. (See title and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Peterson, Peleg, Pham and Kang. All of the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination of Peterson, Peleg, Pham and Kang would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

The suggestion/motivation for doing so would have been "…because the multiperspective plane sweep approach described herein is both computationally efficient, and applicable to both the case of limited overlap between the images used for creating the image mosaics, and to the case of extensive or increased image overlap." at paragraph [0051], Kang.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Peterson with Pham and Kang to obtain all the specified claimed elements of Claim 23.

14. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson US (6,411,742 B1) in combination with Peleg (US 2003-0076406 A1) and Pham et al. "Color Correction for an Image Sequence", 1995, IEEE, pages 38-42, and further in view of Kang et al (US 20030235344 A1) and Xiong (US 5,549,651 B2).

Regarding Claim 24: (Currently Amended): Peterson in combination with Peleg, Pham and

Kang in combination disclose/teach all the claimed elements as rejected above. Peterson in combination with Peleg, Pham and Kang does not expressly teach the cut line is determined by calculating mean squared difference values for pairs of pixels between the two selected image strips.

Xiong teaches the cut line is determined by calculating mean squared difference values for pairs of pixels between the two selected image strips ("Different combinations of overlapping areas are tried to achieve the optimal overlap between images (or, equivalently, the smallest error in the error function or pair wise objective function described herein) using the steps described herein, which generally minimizes the average squared pixel intensity (e.g., brightness and contrast) difference with respect to certain transformation parameters." at column 4, line 65).
At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to calculate the minimized line is determined by calculating mean squared difference values for pairs of pixels between the two selected overlapping image strips.

Peterson, Peleg, Pham, Kang and Xiong are combinable because they are in the same field of creating high quality virtual panoramas. (See abstract Xiong).

The suggestion/motivation for doing so would have been to "yield dramatic improvements during the mathematical, authorization processes and projection cycles with speeds up to several order of magnitude faster than any prior system." (Abstract, Xiong).

Therefore, it would have been obvious to one of ordinary skill in the art to combine the claimed elements of Peterson, Peleg, Pham, Kang and Xiong to obtain the specified claimed elements of Claim 24.

Regarding Claim 25 (Original) Xiong teaches wherein at least one of the images is warped where the differences between the selected strips along the cut line exceed a predetermined threshold (Where the images overlap there is potential for misalignment when constructing a 3D panorama, as indicated by blurry lines 112, for a variety of reasons, ... distortions that occur when warping a 2D image to construct a 3D image space. The present invention is designed to calibrate and align all such 2D rectilinear images with respect to one another and globally, blend the images where they overlap, and construct a reconstructed and relatively error free 3D panorama image, shown conceptually in 2D form as FIG. 1(b), for any arbitrary geometry." at column 3, line 41).

15. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson US (6,411,742 B1) in combination with Peleg (US 2003-0076406 A1) and Pham et al. "Color Correction for an Image Sequence", pages 38-42.

Regarding Claim 26: (Currently Amended) Peterson teaches system for blending images into a single image (Refer to Figure 1, numeral 10), means for determining a cut line through the two images where the difference values are minimized (Refer to column 5,line 17+; also refer to Figure 3c, 3c-1 by way of numeral 54); and means for blending the two images along the cut line to create a blended single image (Refer to column 1, line 51).

Peleg teaches: means for dividing two images having overlapping content into strip along a common plane in at least one region of overlap wherein each strip is a long and narrow piece of the image having one dimension which is greater than another dimension of the respective strip (Refer to Figure 6, numerals 601-604);

Pham teaches means for calculating difference values between the image data content of respective pixels of the two images in corresponding strips of uniform length in the at least one region of overlap (Refer to page 38, Section "Mapping Construction"; "We wish to find a mapping that will convert the color value of each of the pixels in A' to the corresponding pixel color value in B'.")

Peterson, Peleg and Pham are combinable because they are in the same field of merging images into panoramic images (see title of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to calculate difference values between the image data content of respective pixels of the two images in corresponding strips of uniform length in the at least one region of overlap.

The suggestion/motivation for doing so would be that to create an environment that eases "multiple regression steps to find the relationship between the registered overlapping regions of two adjacent images in a sequence." see page 38, right column, paragraph 2, Pham.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Peterson, Peleg and Pham to obtain the specified claimed elements of Claim 26.

16. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al (US 20030235344 A1).

Regarding Claim 27: (Currently Amended) Kang teaches a system for blending images into a single image ("A system and method for deghosting mosaics provides a novel multiperspective plane sweep approach for generating an image mosaic from a sequence of still images, video images, scanned photographic images, computer generated images, etc." at abstract), comprising: a first computing module dividing two images having overlapping content into strips along a common plane in at least one region of overlap ~~wherein each strip is a long and narrow piece of the image~~ (Refer to Figure 1, numeral 145, 146, also refer to Figure 2, numeral 200);~~-~~a second computing module calculating difference values between the pixels of the two images ~~in corresponding strips of uniform width~~ in the at least one region of overlap (Refer to paragraph [0058], also Figure 2, numeral 230), wherein the difference values individually correspond to a difference of image data content between a pair of corresponding pixels of the two images (Refer to paragraph [0057]); a third computing module determining a cut line through the two images where the difference values are minimized (Refer to Figure 1, numeral 145, 146, also Figure 2, numeral 230); and a fourth computing module blending the two images along the cut line to create a blended single image (Refer to Figure 1, numeral 145, 146; paragraph [0080], also Figure 5).

Kang does not specifically/expressly disclose the claimed elements of the system with the equivalent subject matter as claimed in Claim 27. However, Kang does teach the computing modules that support the system claimed limitations of Claim 27. All of the claimed method

steps have been rejected by one of the claimed combination as rejected above. Claim 27 stands rejected based upon the functionality of the system of Claim 27 as taught and fully supported by the disclosure of Kang. Claims 1 and 21 equally resemble the claimed subject matter of Claim 27, therefore, claim 27 is also rejected for those reasons as stated above.

Regarding Claim 41: (New) Peterson teaches the pairs of the pixels individually correspond to the same subject present in the two images ("Referring again to FIG. 1, the positioning module 50 of the image stitching software 14 determines the relative positions of the segments depicted in two of the images 18a-18d so that an image of an object depicted in one of the images can be aligned with another image of the same object." at column 3, line 59).

17. Claim 28-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al (US 20030235344 A1) in combination with Peterson US (6,411,742 B1).

Regarding Claim 28 (Original)**:** Kang teaches all the claimed element as rejected above. Kang does not specifically teach selecting two overlapping strips according to a mean squared difference algorithm such that the sum of the mean squared difference values between the two strips is minimized.

Peterson teaches a system (Refer to Figure 1, numeral 10) including selecting two overlapping strips according to a mean squared difference algorithm such that the sum of the mean squared difference values between the two strips is minimized. (Performed by the portion of Figure 1, numeral 50) "If the outlines of the aligned images intersect at more than two points, the dividing-

line determiner 54 selects the two intersection points that are furthest apart from each other to define the dividing line 80." at column 5, line 32).

Kang and Peterson are combinable because they are in the same field of image transformations, specifically, combining image portions. (See abstract and classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to select two overlapping strips according to a mean squared difference algorithm such that the sum of the mean squared difference values between the two strips is minimized.

The motivation/suggestion for doing so would have been "to save processing time without altering the images and masking out portions of an image." at column 1, line 50+, Peterson.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings/disclosures of Kang in combination with Peterson to obtain the specified claimed elements of Claim 28.

Regarding Claim 29: (Original) Peterson teaches the system (Refer to Figure 1, numeral 10) including: a fifth computing module cutting the two images along the cut line (Performed by the portion of Figure 1, numeral 54); and a sixth computing module joining the cut images together to create the single image (Performed by the portion of Figure 1, numeral 58; "Determining the position of the segment depicted in the second image relative to the segment in the first allows the method to blend images that may represent segments of the view that are arbitrarily

positioned relative to each other. It also allows the method to blend images that may have arbitrary shapes and sizes." at column 1, line 51).

Regarding Claim 30: (Original) Peterson teaches the system (Refer to Figure 1, numeral 10) wherein at least one of the cut images is warped along the cut line to improve the fit between the two images along the cut line (Performed by Figure 1, numeral 56; "Refer to Figure 2b; "Thus, the image stitching software 14 allows a user to blend multiple images 18a-18d to create a panoramic image 26 with a field of view that is larger than the field of any one of the multiple images." at column 3, line 52).

Regarding Claim 31: (Original) Peterson teaches the system (Refer to Figure 1, numeral 10) the blending of images is performed iteratively, with the blended single image being utilized as one of the two images to be blended ("The stitching software 14 checks (222) whether there are any more images between the reference image 18a and the current image 18b'. If there are more images, the stitching software 14 sets (224) the reference image to be the next image after the current reference image and repeats the process of setting a section of the current image 18b' invisible 208-220 described above." at column 5, line 46).

Regarding Claim 32: (Original) Peterson teaches wherein the system is included in one of a video camera or a digital camera ("For example, the image 18 to be blended may be obtained from a digital camera, storage 16 or a network 26." at column 7, line 17).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is (571)270-1583. The examiner can normally be reached on Monday-Thursday 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mia M Thomas/

Examiner, Art Unit 2624

/Vikkram Bali/

Supervisory Patent Examiner, Art Unit 2624